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Analysis of Cocoa Industry Development Factor with System Approach in West Sumatera, Indonesia

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Abstract

The opportunity to develop cocoa industry in West Sumatera is higher with the increase of cocoa production. In the development of the cocoa industry needs to consider various factors, while also needs to study the relationship between the government, farmers and cocoa industry that contained in one system. The purpose of this research is to analyze the cocoa industry development factor with the system approach and to determine the right location for the development of cocoa industry in West Sumatera. The collected data is primary and secondary data. Scoring is done using paired comparison techniques that are aggregated from expert opinion. Determination of cocoa industry development location is held by analitical hierarchy process (AHP) technique. The result of analysis shows that the cocoa processing industry development processors consist of 5 groups, there are (1) mean industry (cocoa industry), (2) buyer, (3) supplier farmers, (4) supporting industries, and (5) supporting institutions. The most important factors in the development of the cocoa industry are fixed investment costs (0.153), marketing of processed cocoa (0.147), availability of facilities and infrastructure (0.139), availability and continuity of raw materials (0.108), and government support (0.097). The most potential areas for the development of the cocoa industry are 50 Kota District (0.183), Padang Pariaman District (0.166), and Tanah Datar District (0.163).

Keywords: cocoa industry; development factor ; system approach.

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1. Introduction

Cocoa plant is found in almost all areas of West Sumatra Province, so that the area and production of cocoa West Sumatra increased significantl [6]. The total land area of cocoa in West Sumatera in 2015 reached 155,994 ha or 10% of the total land area in Indonesia with a production share of 52,917 Ton [3]. There are 12 districts and municipalities that West Sumatera will develop for cocoa, but now it is focused on 5 districts, there are Padang Pariaman District with plantation area of 32,510 Ha (21%), Pasaman 27,499 Ha (18%), Pasaman Barat 20,785 Ha (13 %), 50 Kota 10.753 Ha, and Tanah Datar 8,950 Ha (6%) [2]. These five locations are assisted by Swisscontact in coaching, special coaching will be held for three years. The Government of West Sumatra Province has also developed cocoa plantations using the Nagari-based approach [6]. The development of this plantation area is a positive thing in improving the people's role in agricultural development [16], but the development of cocoa plantation areas in West Sumatra has not been followed by the development of the cocoa processing industry.

The cocoa of West Sumatera is still exported in the form of dry cocoa beans due to the lack of cocoa industry; therefore the development of the cocoa processing industry needs to be held in order to increase the added value of cocoa, strengthen the cocoa industry, and employ the job seeker [4]. Besides, that industrialization of cocoa commodities that have the potential to be exported can increase the competitiveness in spurring national economic growth and increasing the income of farmers. Various policies have been made by the government to support increased investment in the cocoa processing industry. The Government has issued a policy of export duty through Regulation of the Minister of Finance No. 67 of 2010 concerning Stipulation of Export Goods Subject to Export Levy and Export Duty Tariff. In addition, the non-tariff policy applied by cocoa seed importing countries is considered as one of the problems in the development of Indonesian cocoa beans exports [12]. On the other hand, the policy makes cocoa supply to domestic industries bigger so that the enforcement of the policy also supports the downstream program and has had a sweet impact on the decline of cocoa seed exports.

The development of the cocoa industry needs to consider various factors, including the economic factor, especially the availability of raw materials, and the government's policy towards the development of the cocoa industry [16]. Furthermore, in developing the cocoa industry also needs a connection between the government, producer farmers and factory [7]. All these elements are present in a system that has relationships between complex elements and have interdependencies. Therefore, the purpose of the research is to analyze the factors of cocoa processing industry development with the system approach and to determine the appropriate location for the development of the cocoa industry in West Sumatera.

System Analysis

System is a business entity consisting of the related parts each other, the system approach is always looking for integration between parts through a full understanding in a case of mind [8]. The system is the whole interaction between elements of an object within certain environmental boundaries that work toward the goal [9]. System analysis is used to understand system behavior, identify important factors of system success, problems

encountered and alternative solutions that can be put forward to solve the problem [11]. The steps that need to be held are: (1) Needs analysis aims to describe the needs of each of the actors involved in activities [4], (2) Problem formulation, moving from the gap between the real conditions after situational analysis and the conditions that should be, and the existence of a conflict of interest between the perpetrators in a system, (3) Identification of the system, is a picture of a system that shows the chain of relationships between needs and problems encountered. The system identification is represented in the form of system structure diagram, causal loop and input-output diagram.

2. Materials and Methods

Method of Research is using system approach. Stages of research implementation are: literature study, field study and expert opinion survey. Observations were conducted in all districts of West Sumatera cocoa production centers conducted in May 2016 until April 2017. The data were obtained from related institutions, The businessman, cocoa farmers, cocoa processing industries and experts. The experts involved in the study consisted of researchers / lecturers, businessman and government staffs. The affecting factors of development of the cocoa industry are obtained through situational analysis, needs analysis and system identification were then submitted to experts to be scored. Scoring of factors is done using pairwise comparation technique which was aggregated from the opinion of three experts. The selection of cocoa industry locations is based on several selection criteria and these elements are derived from the opinions of experts obtained through quisioners and interviews which are further aggregated with analytical hierarchy process (AHP) techniques. The working principle of AHP is the simplificating of an unstructured complex problem, strategic and dynamic into parts, and arranges in a hierarchy. Then the importance of each variable is given a subjective numerical value compared with other variables. From these considerations then synthesized to establish the variable that has the highest priority and plays a role to influence the outcome of the system [8]. The basic idea of working principles of AHP is: (1). Preparation of hierarchy Issues to be solved are described as elements, ie criteria and alternatives, then organized into hierarchical structures; (2) Criteria and alternative assessment: Criteria and alternatives are assessed by paired comparisons [13]. The value and definition of qualitative opinion from the comparison scale as presented in Table 1.

Table 1: Criteria and Alternative Appraisal of AHP

Value	Definition
1	Criteria / alternative A is as important as the criterion / alternative B
3	A is slightly more important than B
5	A is clearly more important than B
7	A is clearly more important than B
9	A is absolutely more important than B
2,4,6,8	When in doubt between two adjacent values
Contrary	Reciprocals

The value of comparison A with B is 1 divided by the ratio of B to A. The result of the expert's assessment is aggregated using the geometric mean as below:

$$G=\sqrt[n]{x_1} x\ x_2 x x_3 x \ldots x x_n \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

While :

G = geometric average

N = number of experts

Xi = assessment by i-th expert

Data processing using expert choice program 2000 is the determination of priority where each criterion and alternative pairwise comparations (pairwise comparasions). The relative comparison values are then processed to determine the relative ranking of all alternatives. Both qualitative and quantitative criteria can be compared in accordance with predetermined assessments to produce scores and priorities whom have been calculated by matrix manipulation or through solving mathematical equations. Next is the logical consistency in which all elements are grouped logically and consistently ranked according to logical criteria.

3. Results and Discussion

3.1. Situational analysis

The government encourages the downstream of cocoa-based industries through the establishment of processing units in cocoa bean centers aimed at fostering new entrepreneurs in small and medium sized enterprises. In order to support the policy, the central and regional governments have been providing cocoa machinery and processing equipment in the cocoa-producing districts of West Sumatra since 2012 [15]. Although the central and local governments have provided cocoa processing units, cocoa processing industries in West Sumatra are still operating only small-scale cocoa industry Chokato in Payakumbuh and Adam in Padang Pariaman District.

The production process in Chokato Industry was experiencing a constraint that was in the process of penyangraian, machine capacity could process as much as ± 150 kg / day while the ability of the pressing and pressing machine was only ± 10 kg / day, resulting in delay processing of roasted beans to become pasta, fat and brown powder. The occurrence of processing delay was thought to result in fat in cocoa beans not perfectly extracted at the time of cooking and pressing. Penyangraian aims to form a distinctive aroma and flavor of chocolate and ease the fat out of the seeds [10]. The delayed processing of roasted cocoa beans, allegedly will cause the fat to become solid again due to the fall in temperature in the core of the seed during the delay period [1]. Chokato small industry is only able to extract as much as ± 33% cocoa fat from 50% to be excluded, so the cocoa powder result from the forging process still contains relatively high fat which causes the difficulty of the process of smoothing cocoa powder. In addition, delayed processing of roasted cocoa beans also resulted in changes in chemical properties, such as fat content, water content and pH of the resulting cocoa powder.

Production capacity in the cocoa industry of Adam is 8-16 kg / day in the form of brown paste. The brown paste was processed back into a variety of chocolate-based products, ie chocolate blocks, pure chocolate bars, chocolate bars, chocolate candies, 3 in 1 chocolate powder, and chocolate lulur / mask. Adam's cocoa industry is more susceptible to marketing failures in terms of product, price, promotion or distribution area of marketed products. The sales volume of the marketed product is not the same as the volume of production, and the resulting chocolate can not last long, and easily melts because it does not use preservatives. As for the price of the product is relatively expensive so it is difficult to reach by the community, therefore the market opportunity is very difficult to reach by industry owners. The advantages of these processed cocoa products have been certified halal from MUI West Sumatera.

2.2. System Analysis

Needs Analysis

The cocoa industry development actors consist of 5 groups, there are (1) mean industry (cocoa industry), (2) buyers, (3) supplier farmers, (4) supporting industries, and (5) supporting institutions. The mean industry boundaries are the cocoa industry (upstream and intermediate). Upstream industry undertakes efforts to improve the quality of fermented cocoa beans and certification. The intermediate industry turned cocoa beans into intermediate products such as pasta, fat, cake and powder. Supplier industry consists of cocoa farmers, workshop, processing equipment, fuel. Buyer consists of local market and domestic market. Supporting institutions consist of related agencies (agriculture and plantation agencies, industry and trade agencies), farmer cooperatives, farmers associations, and universities / researchers. Supporting industries are banks with financing schemes for industrial development. Identification of system actors is obtained through survey results, expert opinions, discussions, and field observations [8]. The need for cocoa processing industry development is presented in Table 2.

Table 2: The Needs of Cocoa Industry Development Performers

Perpetrators	Needs (Cacao Industry)
Cocoa Farmers	1. Continuity of cocoa farming
	2. High cocoa price
	3. Guarantees the cocoa market
	4. Cacao plant maintenance capital
	5. Guidance and assistance of government officials
	6. Availability of production inputs and technology at affordable prices
Cocoa Industry	
	1. Investment capital loan and working capital with low interest rate
	2. The price of raw materials (cocoa beans) is low

	3. Quality, quantity and continuity of raw materials
	4. Business continuity
	5. Good profit
farmer groups / cooperatives	6. Policy, regulatory and infrastructure support
	1. The sustainability of the cocoa farming organization
	2. Support of cocoa farmers' facilities
	3. Business capital assistance of cocoa farmer groups
	4. Ease of transaction
	5. Ease of market access and funds
Local government	6. Availability of price information and new technology
	7. Managerial assistance and training
	1. The development of cocoa agro-industry
	2. Employment creation
	3. Environmental sustainability
	4. Regional economic development
Funding Agency	5. Increased Local Revenue
	6. Private sector investment
	1. Smooth distribution and credit repayment
	2. A healthy business climate
Research Institute & University	3. Credit guarantee company
	4. Business feasibility
	1. Support policy, facilities and research facilities
	2. Ease of access to farmers and industry
Cocoa farmer association	3. Cooperation of innovation and technology transfer with industry and government
	1. Support of technical training in cultivation, credit, farmer development and cocoa plantation management
	2. Government policy support
	3. Support research institutes and universities
	4. Ease of access to market information and new technologies

System Identification

Development of cocoa processing industry is a system with complex characteristics because it involves the interaction of various elements; dynamic and probabilistic because it changes from time to time and uncertain, while terms of raw materials, price, market, and others. The relationships and effects between elements are presented in causal circumference diagrams (Figure 1).

The interaction of various elements in the development of the cocoa processing industry was shown in Figure 1. Various policies were implemented by the local government in West Sumatra by developing 12 districts and cities for cocoa, but now focused on 5 areas, these five sites assisted Swisscontact in coaching. Special coaching will be done for three years. Other coaching is through the model nagari, where the model nagari focuses for the development of five cocoa centers. In the model nagari program, all cocoa farmers' community members are channeled to the fermentation managed by nagari model, in this case synergize with BUMNag, which buys cocoa from the community. Cocoa maintenance activities are also done with the rejuvenation process as well as provided superior cocoa seeds by developing superior clones of participated selection of cocoa. With superior cocoa seedlings will produce cocoa with good quality and high productivity. Increased cocoa productivity will have a positive impact on the income and welfare of cocoa farmers. Increased revenue synergistically with the development of the cocoa industry.

The development of the cocoa industry creates jobs, encourages local / regional economic growth and local revenue. And increasing PAD contributes to job creation and local economic growth. Beside that, the provision of funds by the funding institutions makes cocoa development efforts become increasingly passionate, coupled with the increasingly vigorous research institutions and universities in cocoa development efforts to apply appropriate technology results of research studies of scientific institutions.

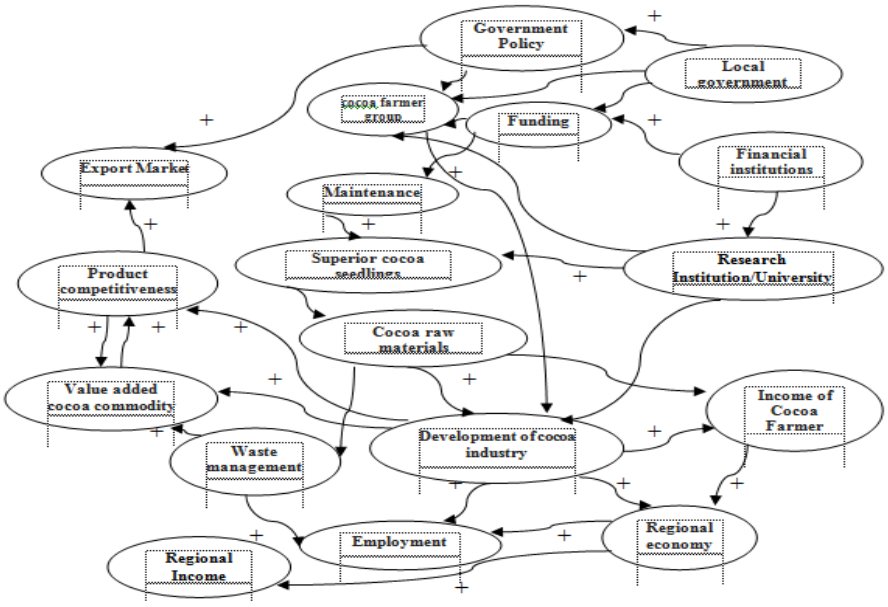

Figure 1: Causal-Loop Diagram Development of Cocoa Industry

The results of system identification are further interpreted in the form of input-output diagram as shown in Figure 2. Industrial development system is an open system in which there is an exchange of energy and information with the environment. The input system consists of internal and external inputs (environment). Control management is required as feedback when an unwanted output emerges.

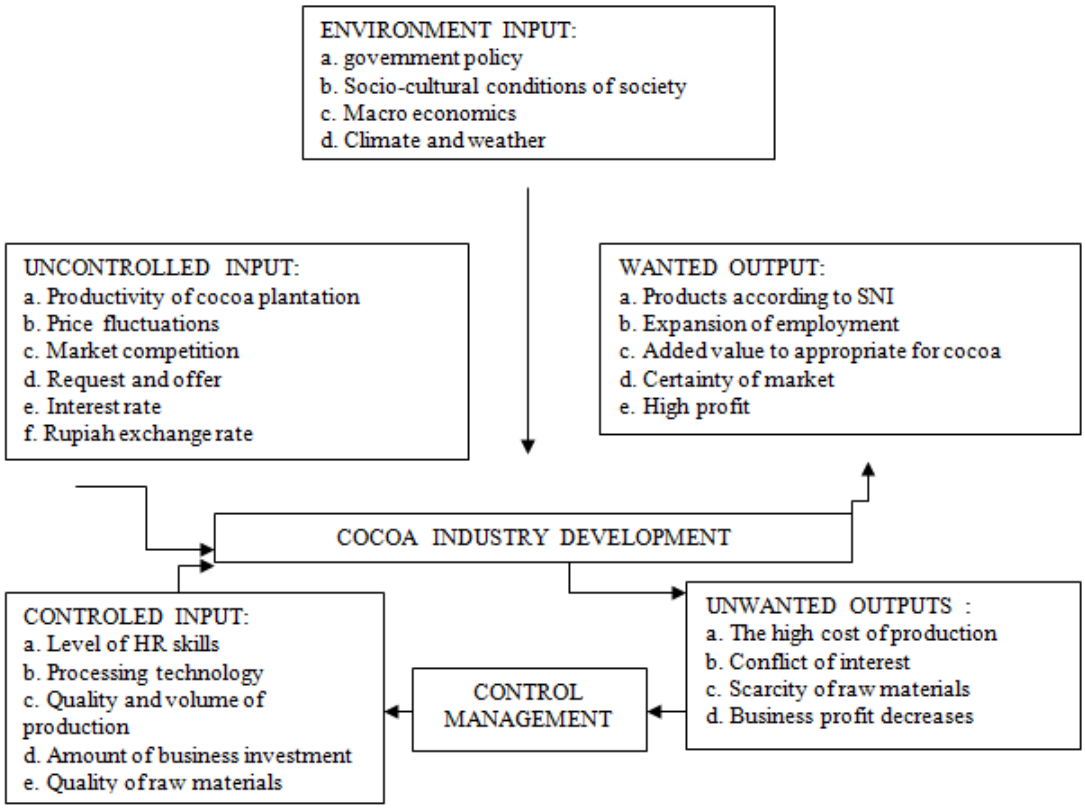

Figure 2: Input-Output Diagram of Cocoa Industry Development

Problem formulation

Based on the result of situational analysis, system identification and requirement analysis of cocoa agroindustry in West Sumatera can be formulated by cocoa processing by mini factory with condition of facility and infrastructure are not support enough, low capacity so that most of West Sumatran cocoa production is sold in dry seed form. This problem is caused by several factors such as availability of investment cost, marketing of cocoa processed products, availability of raw materials, continuity of raw materials, cocoa processing technology, availability of facilities and infrastructure and so forth. Based on these problems can be determined the factors that affect the development of cocoa industry in West Sumatera.

2.3. Factors Affecting Cocoa Industry Development

The development of the cocoa industry in West Sumatra is influenced by many factors. The result of system analysis and expert opinion after being processed using expert choice (Figure 3) puts the fixed investment cost (0.153), is the most important factor where the reality of the current investment factor becomes the main

obstacle of industrial development in West Sumatra. The second factor is marketing of processed cocoa (0.147), which is related to market certainty and easiness of market access. The availability of facilities and infrastructure (0.139), is a third factor, which is the availability of facilities and infrastructure in the form of buildings, equipment and machinery, roads, bridges, irrigation, electricity and telecommunications, fertilizers, and pesticides. The next factor is the availability and continuity of raw materials (0.108), other important factors are government support (0.097) in the form of ease of bureaucracy such as licensing and tax policy, political and monetary stability, fulfillment of quality standardization, and a guaranteed trading system.

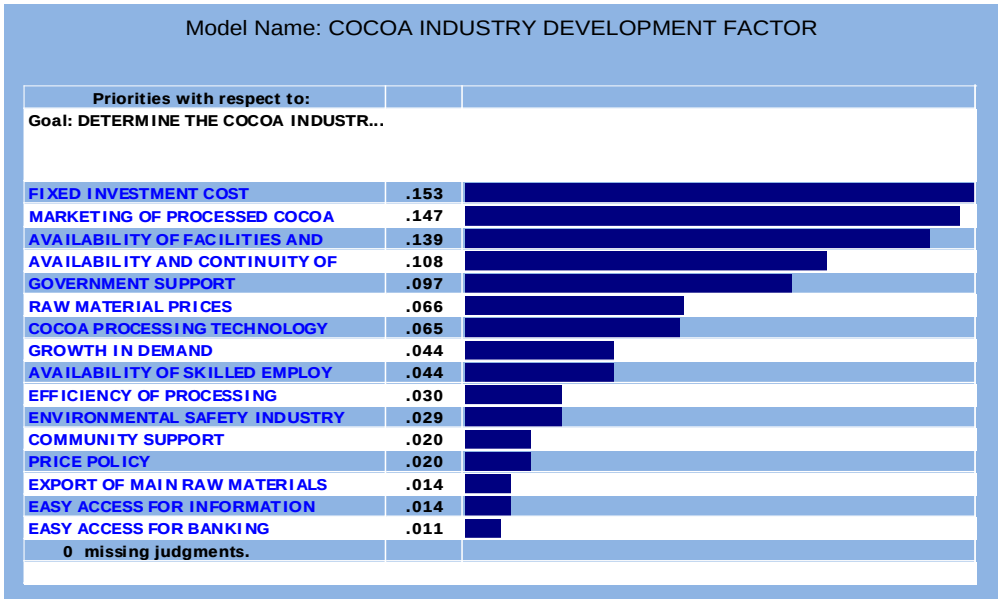

Figure 3: Scoring Results of Factors Affecting Cocoa Industry Development

2.4. Determination of Location of Cocoa Industry Development in West Sumatera

To determine the location of cocoa industry development, the first thing that must be looked is the selection criteria for location determination. Factors for selecting industrial sites consist of primary and secondary factors. Primary factors are factors that directly affect the production and distribution process. The primary factors consist of the availability of raw material resources, marketing, transportation, availability of employees and electricity. While secondary factors include government regulations, taxation systems, local community attitudes and supporting facilities [12].

From these criteria, five criterias are considered dominant in site selection: 1) Fixed investment costs, 2) Availability of raw materials, 3) Availability of employees, 4) Utilities and infrastructure, and 5) Ease of access. By using the AHP Method the five aspects will be determined by the score of interest on the determination of industry location by some related experts through pairwise comparisons, so that it is obtained from each criterion of one score value that determines the priority level and importance in determining the location of the industry (Figure 4). In general, the priority of experts in scoring the criteria for determining the location of cocoa industry development is more concerned with the economic aspects, especially the cost of fixed investment and the availability of raw materials. The subsequent priorities that are considered important in

determining the location of the cocoa industry development are the criteria of utility and infrastructure aspects, accessibility, and availability of employees.

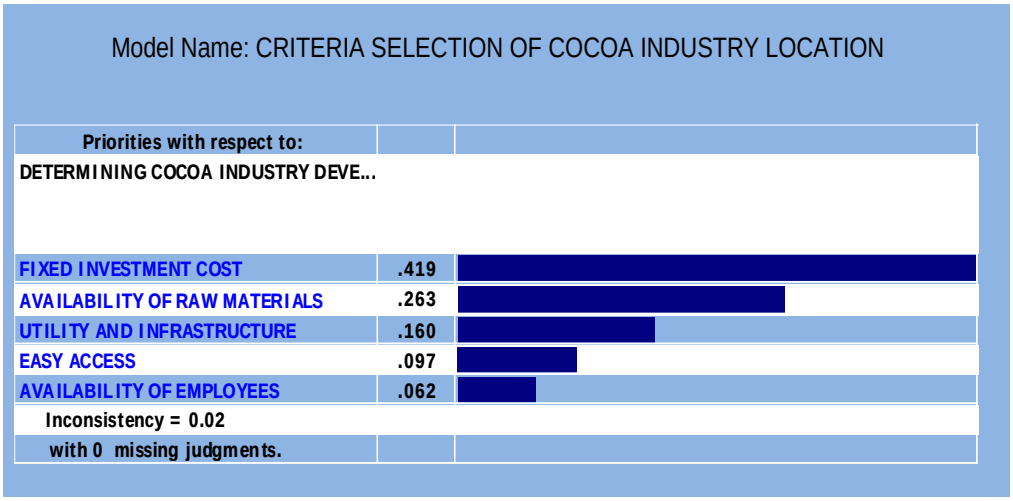

Figure 4: Scoring Results Criteria Determination of Cocoa Industry Development Location

For the cocoa industry development location, there are ten cities and districts that have the highest cocoa production and have adequate facilities and infrastructure, there are : Padang Pariaman, Pasaman, Pasaman Barat, 50 Kota, Agam, Tanah Datar, Solok, Pesisir Selatan District, Dharmasraya Regency, and South Solok District. Subsequently location determination was analyzed using AHP technique with data sourced from several related experts through pairwise comparisons. Alternative scoring results of cocoa industry location are seen in Figure 5.

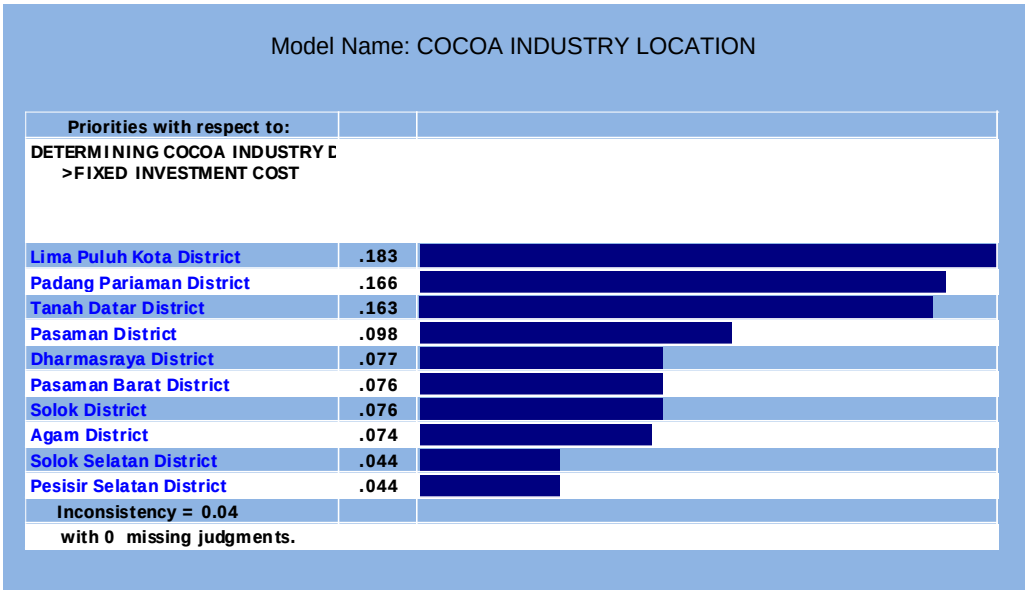

Figure 5: An alternative scoring result of determining the location of the industry

Based on all potential location determination criteria for cocoa industry development and according to expert assessment for each district obtained the total score according to rank from highest to smallest. The top ranked regions are: Kabupaten 50 Kota (0.183), Kabupaten Padang Pariaman (0.166), and Tanah Datar District (0.163). The initial stage to the end in determining the location of industry with AHP method can be seen in Figure 6.

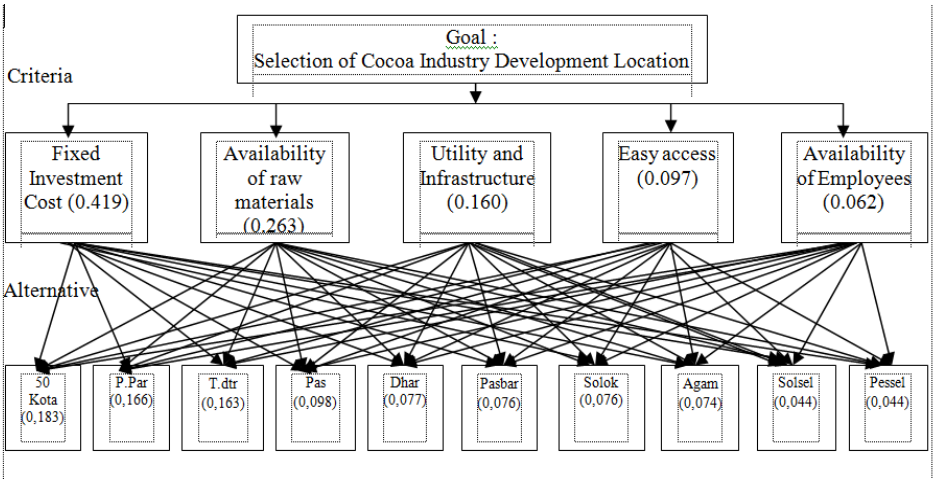

Figure 6: Results of AHP Analysis Determination of Cocoa Industry Development Location

4. Conclusion and Recommendation

4.1. Conclusion

The result of cocoa industry factor analysis with system approach shows that the most important factors influencing the development of cocoa industry in West Sumatera are fixed investment cost, marketing of cocoa processing, availability of facilities and infrastructure, availability and continuity of raw materials, and government support. The most potential areas for the development of cocoa industry are 50 Kota District, Padang Pariaman District, and Tanah Datar District.

4.2. Recommendation

For the development of cocoa industry in West Sumatra by investors and local governments need to consider the factors that influence the successful development of cocoa industry and to determine the location of the appropriate cocoa industry development must be in accordance with the criteria of determining the location of the industry.

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